

FAILURE OF A BRIDGE ON THE CHESTER AND HOLYHEAD RAILWAY.

An extraordinary sensation, to use a hackneyed phrase, has been caused by the failure of the new iron bridge which crosses the river Dee, at the end of the Chester race-course, nearer the city than the well-known one-arch stone bridge built by Harrison, and the sacrifice of many lives. It demands a searching and serious inquiry. The bridge in question is a flat-girder bridge of iron, divided into three spans by two massive stone piers, at equal distances in the stream; and each span is formed of three lengths of cast-iron beams or girders, joined together by bolts, with a semi-circular iron cap over each joint, and the beams being further trussed on the sides by tension or suspension rods, consisting of a number of parallel wrought iron plates. The beams or girders are, in the rib, of two-inch metal; in the flange, 2½ inches. Each beam is about thirty feet in length, and weighs probably thirty tons. Like the Menai suspension bridge, this one has, or rather had, two roadways, the one used for the up trains, and the other for the down trains; and each roadway was carried over the river on two parallel lengths of the beams we have been describing. According to our informant, the roadway and rails used for the trains from Ruabon, &c., to Chester is still entire and uninjured; that used for trains from Chester to Ruabon, is uninjured for two-thirds of its length (viz., the two spans nearest Chester), and for the remaining third, only one of the two parallel beams supporting that roadway (viz., the outside one next the Roodee) has given way, the other remaining apparently uninjured. The length of beam between the abutment and the next pier (95 feet span) has three joints in it, and each joint is secured in various ways, viz., by bolts, legs underneath it, with clips, &c.

The entire length of the bridge is 300 feet; the length of the fallen compartment is 100 feet, its width, 10 feet; and the height above the river at high water is 23 feet.

Although only one girder broke, the weight of the carriages bore down the rails and the horizontal beams, which with the girder, now broken into several pieces, fell into the river. It also tore with it a portion of the stonework in which it was fixed on the Welsh side of the river.

The bridge and river presented a singular spectacle after the accident. The whole of the easterly roadway between the south abutment and the next pier had fallen, that portion of the beam next the pier resting its upper part against the pier, the lower part in the river; and the upper course of masonry of both pier and abutment had been carried down by the beam in its fall. The three carriages and the van were lying, much smashed, in the river; and the south bank was covered with fragments of the roadway.

We find the following particulars in the *Manchester Guardian*:—"Upon examining the beam as it lay in the river, we could perceive two fractures in it,—one of which, in the middle length, had to all appearance been the result of the fall, and not anterior to it. The other, doubtless the immediate cause of this frightful accident, was from 17 to 20 feet distant from the south pier of the bridge; and, as the engine-driver said he felt the giving way beneath him, allowing for the length of the tender, there can be no doubt that this was the fracture which caused the calamity. The fracture was directly across the beam, from its upper to its lower flange; and connected with this was another fracture, running in a line nearly parallel to the bottom flange for about four feet, and then curving across to the upper flange for a length of four feet more. This, however, might have been caused by the fall, the flat side of the beam striking against the rock or other hard substance. The trusses or tension rods, so far as we could see them, appeared to be entire. Until this massive girder is got out of the water, which in part conceals it, it is impossible to say what may have been the cause of its fracture. So far as it could be seen, it did not appear to be from any flaw or defect in the metal. In one account we have seen, the accident, it is suggested, may have arisen either from the piers not being sufficiently consolidated, or the stone defective, or the iron bearings becoming warped by some heavy trains of iron

from Ruabon passing over them, or from an unstable foundation. So far as we could judge, and in the opinion of those more competent to judge than ourselves, none of these appeared likely to be the real cause of the accident. The piers are quite firm and still standing, and just so much of the masonry has gone as the beam would be certain to drag downwards with it; and as to heavy trains of iron from Ruabon, we learn that there had been nothing of the kind—no wagon bringing more than four or five tons of iron. Indeed, the bridge was most severely tested before it was opened to the public, by trains of ballast waggons passing over it,—probably 30 loaded waggons of seven tons each, or 210 tons altogether over the whole structure. There is not the slightest appearance of the foundations having 'settled' in such a manner as to endanger the structure, and it being only one beam that has given way—just one-sixth part of the girders of the bridge—the inquiry seems considerably narrowed. It is said that there was considerable vibration experienced in passing over the bridge, and it has been suggested that, as the beams or girders, &c., are of cast-iron, and the trusses or tension rods and the clips at the joints of wrought-iron, there may have been unequal expansion of the two forms of metal during the late two or three days of hot weather, tending to throw all the resistance upon the cast-iron beams. But a more probable cause seems to be that the trusses have exerted a straining force upon the beam; and we believe there is at least one instance in which these trusses or tension rods have been pronounced injurious rather than beneficial to a flat-beam or girder bridge. We trust the inquiry into the cause by more than one scientific man will throw some light upon this subject, as bridges on the same principle now exist on various railways—one, we believe, the first of the kind, on the Newcastle and Darlington line, one of the oldest in the kingdom, and we know that they are intended to be extensively used on other lines now in progress of construction."

"The Dee Railway bridge was erected by Mr. Betts, who contracted for its construction; but we have not heard who supplied the iron castings, &c. It appears that the bridge was opened on the 1st of November, 1846, as a single line; and about two months ago one of the girders on the same side of the bridge, but in the centre span, was observed to have a crack in it. The westerly roadway being finished by that time, that line of rails was alone used for a time, and the cracked beam was replaced by a new one." It is estimated that the loss sustained by the Shrewsbury and Chester Railway Company, by the damage done to the carriages and tender, will be about £2,000, and that sustained by the Chester and Holyhead Railway Company, by the damage done to the structure, will be £2,000, at least.

On Tuesday, the inquest on the sufferers was opened, but no evidence was taken. The coroner gave notice that he should require the attendance of Mr. Stephenson, the engineer; Mr. Betts, the contractor; and Mr. Lee, the resident engineer. He also advised the jury to appoint an engineer, unconnected with any railway, to inquire rigorously into the cause of the failure; and Mr. Yarrow, who was present, was accordingly appointed for that purpose.

RESTORATION OF HEREFORD CATHEDRAL.—Mr. R. B. Phillips, of Longworth, has issued a letter to the landowners of the diocese of Hereford, urging them, in strong terms, to make further efforts for the completion of the works. It is written in a praise-worthy spirit, and can scarcely fail to have the effect intended. Mr. Phillips draws a striking parallel between the sums subscribed by the Herefordshire gentlemen for the restoration of the cathedral, and the amounts against the names of these same gentlemen in certain railway subscription lists.

SCREW-PILE PATENT EXTENSION.—The Privy Council have granted Mr. Alexander Mitchell an extension for fourteen years of his patent for screw piles, on which to erect light houses, beacons, &c., on the ground that it is one which would not be expected to come into general use for some years, and which, consequently, will not till then remunerate the inventor even at the most moderate rate.

A FRAGMENT ON THE ORNAMENTAL IN ARCHITECTURE.

[TRANSLATED FROM WICHELHAM'S TREATISE ON ANCIENT ARCHITECTURE.]

THE essential in architecture was followed by the ornamental, of which I shall speak in this chapter; first making some general observations, and then entering more into detail.

A building without ornament is like health in poverty, which none consider sufficient by itself, as Aristotle says; and uniformity or monotony can—in architecture, like in the style of writing and other art-works—become blamable. Ornament has its causation in variety; in composition as well as in architecture, it serves the mind and eye as a means of diversification, and if in architecture ornament is coupled with simplicity, beauty arises; because anything is good and beautiful, if it is what it ought to be. Ornaments of a building, therefore, ought to be appropriate as well to their general as essential aim; in relation to the former, they are to appear as accessories; in relation to the latter, not to interfere with the nature of the luxury, and its nearer adaptation. They are to be considered like ornaments, which serve to cover nudity; and, therefore, the huger a building is in its plan, the less ornament is required: like a precious stone, which is merely to be encircled by a golden thread, that it may shine forth in its full lustre.

Ornaments were as rare on ancient buildings as they are on statues, but the members on which those ornaments were placed afterwards were either straight, or but little concave or convex. Not long before the times of Augustus (under the consulate of Dolabella), an arch was erected on the Claudian aqueduct on Mount Caelius in Rome, on which the projecting beam, or cornice of Trautwin, extends above the inscription obliquely, still in a straight line, which silliness would not have happened at a subsequent period.

When, however, variety was sought for in architecture, which arises from depressions or elevations, or by concave or convex lines, the straight members and orders were broken through, and by this some variety was achieved. This variety, however, which was imparted to every order of architecture in a different way, was, properly speaking, not considered as an ornament, which, in fact, was so little sought for by the ancients, that the word for it was only used by the Romans for ornament in dress. Because, as genuine good taste was failing, and appearance was preferred to reality, ornaments were no more considered as accessories, but the spaces, which had hitherto remained empty, were filled with them. Thence arose the *titulus* in architecture; because, if every part is little, the whole is little too, as Aristotle said. Architecture underwent the same changes as the old tongues; they became richer as they declined from their beauty, which can be proved as well of Greeks as Romans; and as architects could either not reach the beauty of their predecessors, or not surpass it, they endeavoured to appear at least richer.

The superabundance of ornament began probably under Nero; because in the times of Titus, this fashion was prevalent, as we see in his arch; and under the following emperors it went on increasing. What architecture had become in the reign of Augustus, the palaces and temples of Palmyra show; because all that remains of them was probably built shortly before or in his times, as all these buildings exhibit the same style. Whether that immense piece of a marble architrave in the gardens of the palace of Colonna be of a temple of the sun built under that emperor, cannot be decided.

The architraves of doors and windows were formed as of wreaths of flowers and foliage, as it appears in the temple of Baalbek, and many such doors are also to be seen in Rome. The columns were not exempt from this encroachment; the whole base with its members was surmounted with wreaths, as are those under the porphyry columns on the so-called *Battisterio* Constantini at Rome, and another base of uncommon size in the church of St. Paul, near Rome, which is seven palms in diameter. Similarly carved were those discovered in our times on the Palestine hill.